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# Sound and Waves: An Integrated K–8 Hands-On Approach Supporting the NGSS and CCSS ELA

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# Sound and Waves: An Integrated K–8 Hands-On Approach Supporting the NGSS and CCSS ELA

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# Sound and Waves: An Integrated K–8 Hands-On Approach Supporting the NGSS and CCSS ELA

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# Preparing College/Career Readiness through Integrating Science Learning with Literacy in Grades 6-12

A LEA-IHE-Business Partnership Initiative Supported by TN DOE MSP and THEC ITQ Grants (2015-17)



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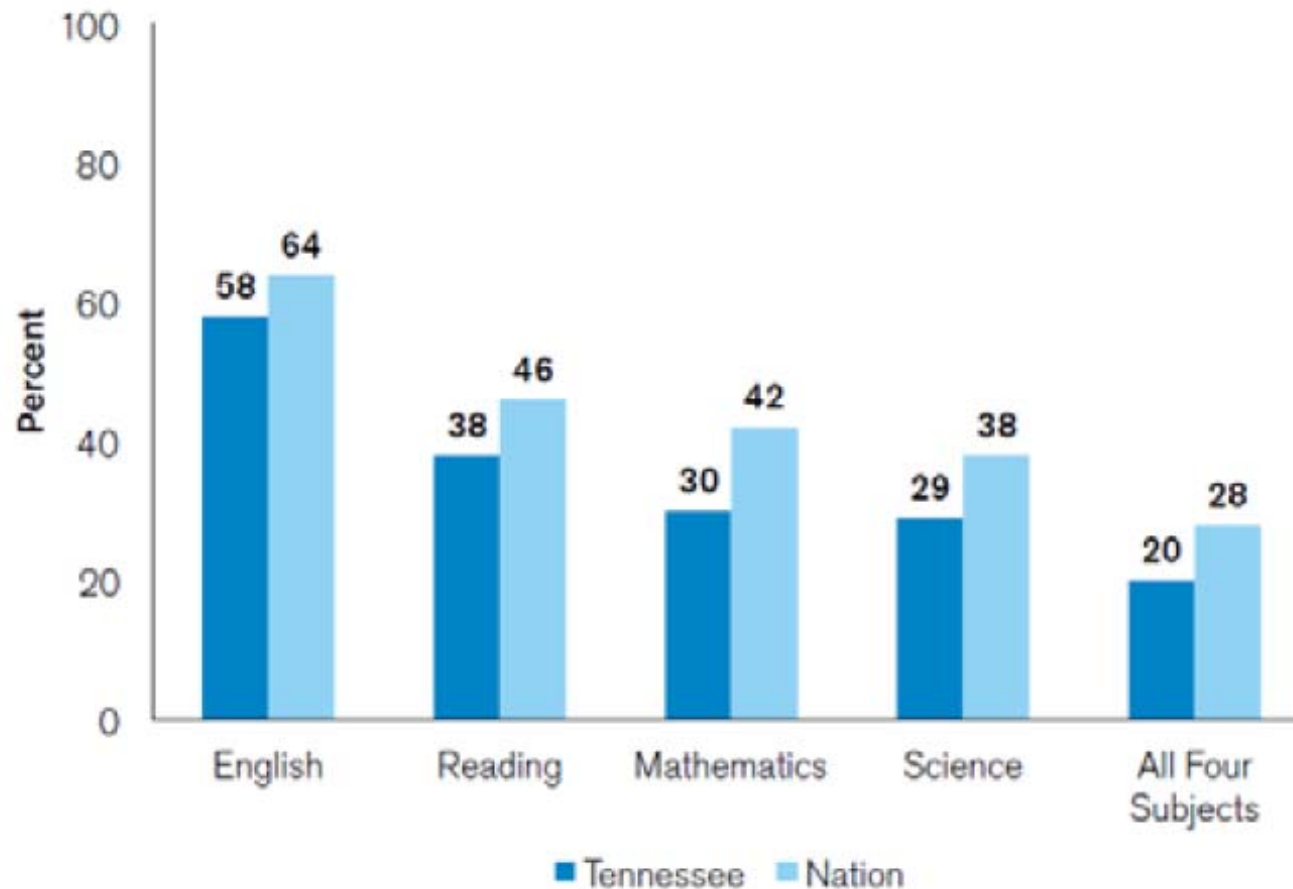
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# Picture of College Readiness

Percent of 2015 ACT-Tested High School Graduates Meeting ACT College Readiness Benchmarks by Subject



## Research Questions

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- **RQ1**: How does cross-discipline instruction benefit and enrich each subject discipline?
- **RQ2**: How does integration of science learning with literacy in G6-12 impact college/career readiness?

# Excitement in Sound & Waves

## What do you feel excited about sound?

- Celebrations (5<sup>th</sup> grader)
- Pretty (2<sup>nd</sup> grade)

## What do you feel excited about waves?

It is cool when you see it change because it is like it is a show in front of you and it is also like something you never seen before and never did before and also the first person to do it and it is also like the coolest thing ever. I think it is real cool to do the light's and real cool to do sound and waves.

A second grader





# A Plan to Be A Knowledge Rocker

Science Content	Hands-on activities	ELA Strategies
<b>I. What</b> is sound? <b>How</b> is sound made?	<ul style="list-style-type: none"><li>• Kazoo straws</li><li>• Wine glasses</li><li>• Ukuleles</li></ul>	<ol style="list-style-type: none"><li>1. Non-fiction texts</li><li>2. Text evidence</li><li>3. Cite and justify evidence</li><li>4. Use evidence in writing</li></ol>
II. How does sound <b>travel</b> ?	<ul style="list-style-type: none"><li>• Pulse of air</li></ul>	
<b>III. Types of waves:</b> transverse vs. longitudinal	<ul style="list-style-type: none"><li>• Ropes/ slinkies</li><li>• Wave gadgets</li><li>• Group of people</li></ul>	
IV. From <b>noises</b> to <b>music</b>	<ul style="list-style-type: none"><li>• Kazoo straws</li><li>• Straw flute</li></ul>	





# Summary of NGSS PS4 / TN Standards in K-8

## K- 2 (1)

- Sound can make matter vibrate, and vibrating matter can make sound

## G3-5 (4)

- Waves are regular patterns of motion, which can be made in water by disturbing the surface. Waves of the same type can differ in amplitude and wavelength. Waves can make objects move.

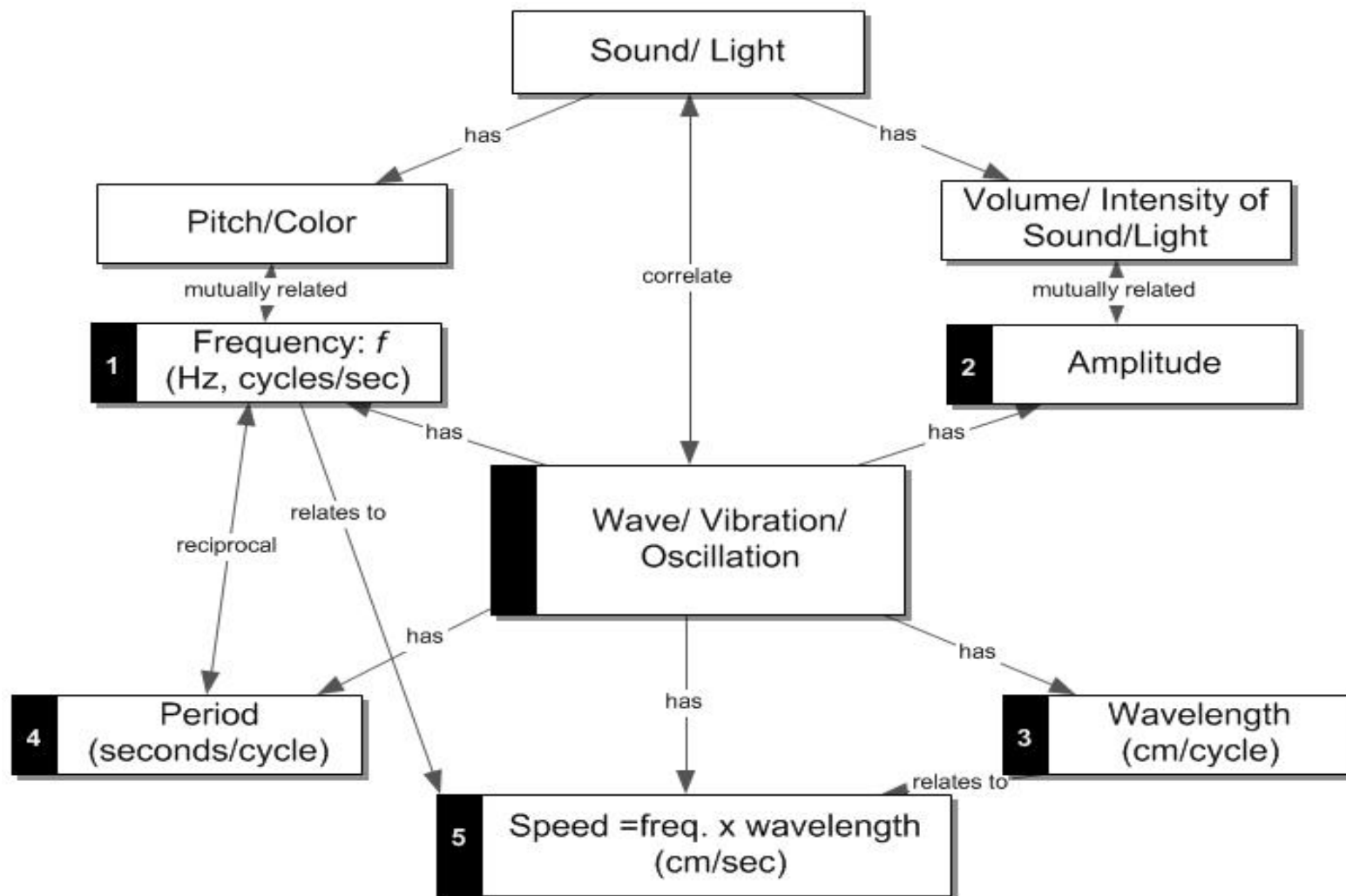
## G6-8

- A simple wave model has a repeating pattern with a specific wavelength, frequency, and amplitude, and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena including sound and light. Waves can transmit energy.

## TN Standards

- G3: Distinguish between pitch and volume/ Identify how sounds with different pitch and volume are produced.
- G7: Compare and contrast the different parts of a wave/ Compare how transverse and longitudinal waves are produced and transmitted

# A Concept Map of Sound and Waves in K-12



# What IS Sound/ How Is Sound Made

## A. Kazoo Straws ([videos](#))

1. Let's do it. First play one straw then make another one according to your sitting area (see right).
2. Q: How to make a kazoo straw with a higher pitch? Why?

Stage	
16cm	8cm
12cm	14 cm

## B. Two wine glasses w/ different amount of water

1. Which one has a higher pitch? Why?  
(Use feedback detector)
2. How is sound made?

## C. A ukulele with frequency detector app

1. Does a bigger sound have a higher pitch?



## Features of nonfiction text

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- Nonfiction books contain text features which ultimately help readers but may initially be ignored or difficult to decipher.
- Features provide a wealth of information but students may need explicit instruction in how these features help them as readers (Harvey, 2002).
- See handout for list of nonfiction text features



## Teaching Nonfiction Text Features

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- Students peruse books noticing similarities and differences between fiction and non-fiction.
- Create a class chart similar to that provided that illustrates what students noticed, defining each feature, discussing how the feature helps them as a reader, and pointing out the nonfiction text features they are not able to name.
- Model the similarities and differences of nonfiction and fiction text through familiar read alouds.



# How Does Sound Travel/ How Does Waves Move

## A. A pulse of air

1. Hypotheses about how sound travels.

## B. Types of waves

Transverse	Longitudinal
<ul style="list-style-type: none"><li>• Ropes</li></ul>	<ul style="list-style-type: none"><li>• Slinkies</li></ul>

- Q: How to use a group of people/kids to simulate two types of waves?



# How Does Waves Move

## A. Components of a wave movement

1. Frequency
2. Wavelength
3. Amplitude

## B. Wave movement demonstration (transverse type)

- Frequency (Hz) activity using flash strobos
- Identify/ describe a wave movement
- Find wavelength and amplitude of a wave





## Text Evidence

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- Argument is “at the heart of critical thinking and academic discourse, the kind of writing students need to know for success in college” (Hillocks, 2010, p. 25).
- good argument begins with looking at data that are likely to become the evidence in an argument and that give rise to a thesis statement or major claim” (Hillocks, 2010, p. 26).
- Students need an understanding of the components of argument and the process through which careful examination of textual evidence becomes the beginnings of a claim about text.

## What influences students' ability to cite and justify evidence?

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- Writers' background knowledge, prior experience, and practice with sources, as well as motivation for the task, influence students ability to choose and justify evidence.
- Background or contextual knowledge includes familiarity with the discourse and disciplinary ways of composing arguments. (Andrews, Torgerson, Low, & McGuinn, 2009)



## Effective strategies for teaching students to use evidence in writing (I):

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- Modeling the search for and appropriate use of evidence from many types of sources (both print based, Internet, and first-hand data) in different disciplines
- Replacing punishment-based reactions with instruction-based ones
- Attending to the dual challenges faced by English language learners



## Effective strategies for teaching students to use evidence in writing (II):

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- Involving students in authentic research endeavors to facilitate discussions of the creation of bodies of first-hand data
- Teaching how to cite patch writing (see Patch Writing handout)
- Teaching use of structural phrases (see Structural Phrases handout)

<http://citationproject.net/plagiarism-definition.html>.



# From Noises to Music

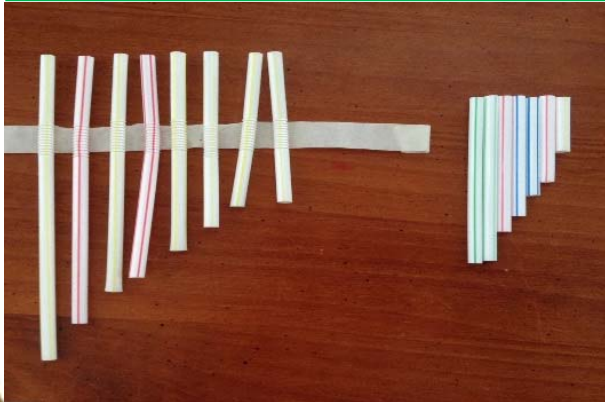
## A. Kazoo Straws ([videos](#))

Let's resume our Kazoo activities and cheer up!

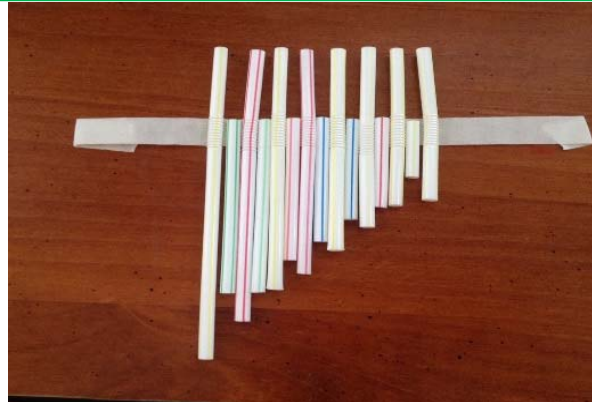
Stage	
16cm	8cm
12cm	14 cm

## B. Make a straw flute instrument (see bags, handouts)

Step 1



Step 2



Step 3



## Math in Straw Flute (optional)

1	2	3	4	5	6	7	8
19.0 cm	16.9 cm	15.0 cm	14.1 cm	12.7 cm	11.3 cm	10.0 cm	9.5 cm
Do	Re	Mi	Fa	So	La	Si	Do

#1/#5	#2/#6	#3/#7	#1/#8	#1/#4
3/2	3/2	3/2	2/1	1.347

Two combinations

- Do + So (Harmonic)
- Do + Fa (Dissonant)



# Twinkle, Twinkle Little Star

11 55 66 5 44 33 22 1

55 44 33 2 55 44 33 2

11 55 66 5 44 33 22 1





## From Isolated Facts to Written Composition

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Write an argumentative composition (1 paragraph) that has

- One text feature,
- Makes a claim about something you learned during the hands-on activities,
- Supports that claim using a direct quote underlined in the article, and
- Supports that claim using patch writing from a quote underlined in the article.



# Questions and Comments

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